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## Endodontic treatment of biradicular mandibular canines: Case reports

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### Abstract

The knowledge of root canal system of different human teeth is a “road map” for the successful root canal treatment. Mandibular canine usually contains one root with a single root canal, but rarely it may possess two canals and even less frequently two roots and two or three canals. Two-rooted mandibular canine is a rare phenomenon. Literature report shows incidence of two-rooted canine as low as 1.7%. This article highlights the identification and endodontic management of two cases of a rare anatomical variation in mandibular canine with two roots and two canals.

**Keywords:** root canal treatment, mandibular canine, anatomic variation, two roots, two canals

### Introduction

The aim of endodontic treatment is to eliminate microorganisms from the root canal system and prevent reinfection. Successful root canal therapy requires a thorough knowledge of tooth anatomy and root canal morphology [1] Variation in root and root canal morphology can be found in any tooth in the dental arch with varying degree of incidence. Careful evaluation of research material has shown that variations in tooth morphology are common [2] A thorough knowledge of the external and internal anatomy of teeth with its possible aberration is essential to ensure the success of endodontic treatment.

The mandibular canine is a strategically important tooth in the dental arch. Its long and stable root is useful for prosthetic support due to its proprioceptive properties that regulate or guide masticatory function, combined with its role in occlusal guidance during the eccentric movements and posterior disocclusion [3]. Morphologically, mandibular canine is usually considered a monoradicular tooth with single root canal [4-7] However, since the beginning of the 21st century, due to introduction of new technologies related to intraoperative vision magnification and innovative radiological imaging systems, there has been a noticeable increment in the number of clinical studies, in vitro/ex vivo studies, and case reports that have revealed morphological variations, such as the presence of two roots and two root canals in the mandibular canine.

The anatomical variations associated with permanent mandibular canines have been reported by several investigators. Pineda and Kuttler, [5] Green [8] and Vertucci [6] reported that the occurrence of mandibular canines with one root and two root canals is approximately to be about 0%–24%. At the same time, the incidence of mandibular canines having two roots and two canals was reported to be rare ranging from 0% to 5% [9-11]. The following clinical case report illustrates 2 cases of mandibular canine with two roots and two root canals

### Case Report 1

A 36-year-old male patient reported to Department of Conservative Dentistry and Endodontics with a chief complaint of pain in lower left front tooth region from last 2 months. Clinical examination revealed mandibular left canine #33 had severe attrition and tenderness on percussion. Thermal and electric pulp tests showed delayed response. Radiographic examination revealed a sudden loss in the continuity of the canal suggesting the presence of a mandibular canine with two independent roots and two roots canals. On the basis of the clinical and radiographic findings, a diagnosis of asymptomatic irreversible pulpitis and

normal periapical tissues was established.

A root canal treatment was planned and local anaesthesia was administered. With the aid of magnification throughout the treatment, the pulp chamber roof and the lingual cervical ridge were eliminated to obtain access to the second canal, the radicular pulp space was carefully screened with the DG-16 endodontic explorer (American Eagle, CA, USA), and the entrances of two root canals were found, one buccal and one lingual.

Working length was measured with Canal Pro Apex Locator (Coltene, Whaledent GmbH, Germany) and confirmed radiographically. Canal preparation was done with ProTaper rotary system (Dentsply-Maillefer, Ballaigues, Switzerland) till size F3 for each canal. Irrigation with 3% NaOCl was done in between change of instruments. Calcium hydroxide (Prime dental PVT, India) was placed as an intracanal medicament for 1 week. Obturation was done with the corresponding ProTaper gutta-percha (Dentsply-Maillefer, Ballaigues, Switzerland) using AH Plus sealer (Dentsply) Later on, post endodontic restoration was done with composite resin. The patient was asymptomatic during follow-up period.

### Case Report 2

A 55-year-old male patient reported to the Department of Conservative Dentistry and Endodontics presenting with the history of severe pain in the lower left front tooth region for the past 15 days. On clinical examination, there was generalized attrition in the anterior teeth. The adjacent lateral incisor, #32 was deeply carious and required endodontic treatment. The left lower canine #33 was tender on percussion. The tooth showed delayed response to pulp vitality tests as compared to healthy contralateral tooth. Radiographic examination revealed widening of the periodontal ligament space in relation to #33. Based on the clinical and radiographic examination, a diagnosis of necrotic pulp with symptomatic apical periodontitis was established and root canal treatment was planned for #32 and #33. The treatment was explained to the patient and consent was obtained.

On the basis of this information, the treatment protocol was focused on avoiding removal of excessive tooth structure or perforation of the roots. Preoperative radiograph gave the suspicion of two roots in relation to left mandibular canine which was confirmed with multiple angled radiographs. Infiltration local anesthesia with epinephrine was administered, and the access cavity was carried out, and the outline extended buccolingually to accommodate the buccal and lingual root canal. The pulpal floor was carefully examined and then the working length was established using electronic Canal Pro Apex Locator (Coltene, Whaledent GmbH, Germany).

Cleaning and shaping of the apical thirds were performed with rotatory NiTi files (S1, S2, and F1 Universal ProTaper, Dentsply, Tulsa, OK), followed by manual instrumentation with a size #35 Flexo- file in both root canals, Copious irrigation with 2.5% sodium hypochlorite NaOCl and 17% EDTA was carried out during all the instrumentation phases. Intracanal dressing with calcium hydroxide was placed and the access was sealed with a temporary cement. After 7 days, the intracanal medication was removed with 17% ethylenediaminetetraacetic acid (EDTA) irrigation and ultrasonic activation. Once both canals were dried, the lingual canal was first filled, to prevent visibility obstruction, followed by the buccal root canal. Before obturation, the root

canals which were dried by paper point, and the obturation was achieved by Gutta-percha cones and AH-Plus Sealer (Dentsply Maillefer, Switzerland) using lateral cold compaction. The access opening was sealed with temporary cement, and a final radiograph was taken.

### Discussion

This study aimed to present 2 cases of a mandibular canine with two roots and two root canals. In general, the mandibular canine is considered to have a high prevalence of Vertucci's type I configuration [12, 13]. However, the classic articles of Hess (1921, 1925) [14, 15] reported a noticeable low prevalence of single root canal in the mandibular canine (57.1%), which shows that anatomic variations in this tooth are a latent possibility.

Failure to locate and treat an extra root/canal is one of the most common causes of root canal treatment failure. Early detection of a mandibular canine with two roots and two root canals favourably influences the success rate of endodontic treatment, as it allows the use of specific diagnostic tools and the setting of individualized strategies based on the anatomical particularity of the tooth. Therefore, Careful examination of the initial radiograph is extremely important. It allows the identification of multiple roots, root canals, and anatomical variations, detection of a sudden loss in the continuity of the root canal lumen or a radiolucent groove in the lateral part of the root, which are findings that hint to the presence of more than one canal [16].

However, a mandibular canine with two roots can present bifurcation at different root levels, which implies a certain degree of difficulty according to the zone where it is located. When the division is located apically, there is a higher degree of difficulty during the localization and mechanical preparation of the root canals. In contrast, when the division is located more cervically, there are increased risks of perforating the bifurcation during the search for the additional canal.

If a morphological alteration is suspected, acquiring angled radiographs facilitates the detection of extra canals [17]. If necessary, the use of limited field-of-view cone beam computed tomography will help to confirm the internal variations that are not clearly distinguishable with conventional methods [18]. Recently, advanced diagnostic radiographic tools such as cone-beam computed tomography (CBCT) are very helpful to diagnose morphological variations if conventional radiographic techniques provide lack information and more details are required [19]. Moreover, use of magnification tools (magnification loupe or DOM), the use of fiber optics, and sodium hypochlorite NaOCl bubble technique might help to locate any additional root canals.

In mandibular canine with two roots, roots are generally positioned buccally and lingually which can be easily overlooked on preoperative radiograph due to superimposition of roots and canals. Performing an access opening in a straight line is crucial, as it improves visualization of the whole pulp chamber and aids with the determination of the accurate division point, preferably with the combined use of vision magnification and tactile examination with the DG-16 endodontic explorer. Moreover, it is useful to measure, through the root canal, the exact distance between the incisal reference point and the bifurcation zone, either with a periodontal probe or with a type K-file. In the present case, the presence of the two roots was suspected on intraoral periapical as buccal root was present slightly mesially as compared to the lingual root and there was no exact

superimposition of both the roots in angled radiograph. Subsequently, by using ultrasound tips or long shaft burs, the pericervical dentin, which usually obstructs lingual canal access, should be carefully removed up to the distance that was previously determined, by performing small and progressively deeper movements. It is important to be careful with these types of movements, as they could excessively weaken the remaining root structure. The use of such strategies in combination with adequate operator skills could establish straight-line access to the root canals.

According to Sharma *et al.* (1998) [20] and Versiani *et al.* (2011) [12], the prevalence of lateral communications and furcation canals is high, oscillating between 68.9% and 29%, respectively. Therefore, the use of final irrigation based on an apical negative pressure system, ultrasonic agitation, and 17% EDTA increases the removal of organic and inorganic tissue from the zones untouched by the instruments [21] Case reports displaying mandibular canines with two root canals have been published earlier.[22,23] However, presence of two roots in mandibular canines is rarely observed. D’Arcangelo *et al* [2] reported two cases of endodontic treatment of mandibular canines with two roots. Victorino *et al* [24] describes a case report of a patient with bilateral mandibular canine with two roots and two canals.



**Fig 1c:** Master Cone Radiograph



**Fig 1a:** Preoperative Photograph showing 2 orifices in the pulp chamber



**Fig 1d:** Post Obturation Radiograph



**Fig 1b:** Working Length Radiograph



**Fig 2a:** Preoperative Radiograph



**Fig 2b:** Working Length Radiograph



**Fig 2c:** Master Cone Radiograph



**Fig 2d:** Post Obturation Radiograph

## Conclusion

Variations in the internal anatomy among populations could be due to the differences in genetics and racial variations in the population, sample size, techniques, classification systems, and the researchers' judgment and diagnosis. It is important to detect such anatomical variations before the initiation of endodontic treatment like sudden loss in the continuity of the root canal lumen and a radiolucent groove in the lateral part of the root are findings that indicate the presence of more than one canal.

Careful interpretation of conventional radiographs with different angulations and use of advanced radiographic tools such as CBCT, appropriate access cavity design to visualize the entire pulp chamber floor as well as the use of magnifying tools are helpful to evaluate complex root canal anatomy. This allows for the planning of individualized treatment protocol, tailored to their peculiar morphology, focused on avoiding excessive weakening or perforation of the roots.

Although the incidence of mandibular canine with two roots and two or three canals is low, it can exist. A thorough knowledge of the tooth and root canal morphology, clinical exploration, and detailed radiographic interpretation as well as use of advanced radiographic technique such as the cone-beam computed tomography (CBCT) may result in three-dimensional evaluation of root canal configuration, thus predicting success.

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